PATENT ABSTRACTS OF JAPAN

(11)Publication number : 06-176870

(43)Date of publication of application : 24.06.1994

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(51)Int.Cl. H05B 33/12
C09K 11/06
H04N 5/70

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(21)Application number : 04-324520

(22)Date of filing : 04.12.1992

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KOSHO NOBORU

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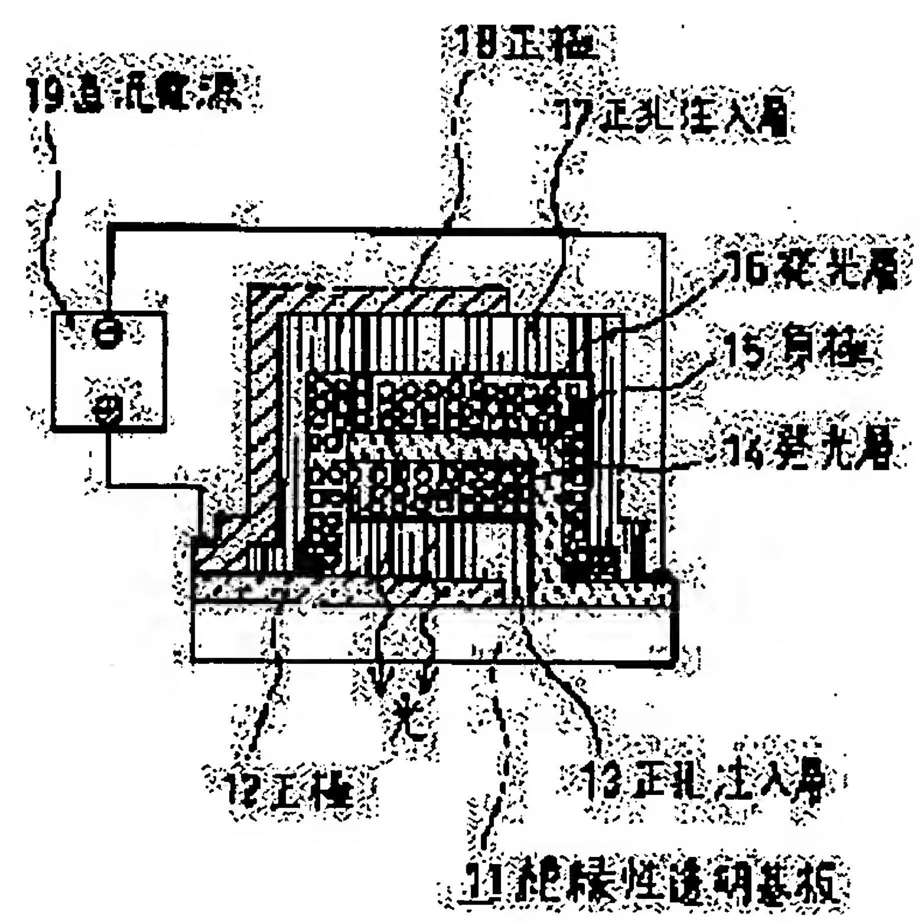
(54) ORGANIC THIN FILM LIGHT EMITTING ELEMENT

(57)Abstract:

PURPOSE: To provide an organic thin film type light emitting element which excels in the reliability

CONSTITUTION: An assembly as the fore stage consisting of an electric charge implanting layer 13 and a light emitting layer 14 and a rear stage assembly consisting of a light emission layer 16 and an electric charge implanting layer 17 are stacked upon an insulative transparent base board 11 in stages while positive electrodes 12, 18 and negative electrode 15 are interposed. The positive electrodes and negative electrode are arranged alternately. The electrodes 12, 18 of the same polarity are connected with each other on the insulative base board. The assemblies laid in stages are stacked so that the rear one encloses the whole surfaces of the fore stage one.



LEGAL STATUS

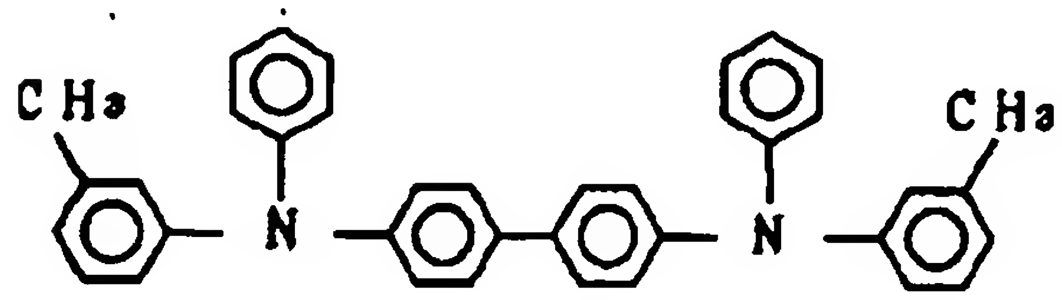
[Date of request for examination]	18.09.1998
[Date of sending the examiner's decision of rejection]	
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	3189438

[Date of registration]	18.05.2001
[Number of appeal against examiner's decision of rejection]	
[Date of requesting appeal against examiner's decision of rejection]	
[Date of extinction of right]	

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the structure of an organic thin film light emitting device of starting the organic thin film light emitting device used as a source of luminescence of various displays, especially excelling in dependability.
[0002]
[Description of the Prior Art] Development and utilization of various display devices are energetically advanced with rapid increase of the need of the flat display which replaces the conventional Braun tube. An electroluminescent element (it considers as an EL element below) is also based on such needs, and attention is attracted with the high resolution and the high visibility it is especially invisible on other displays as a spontaneous light emitting device of all solid-states. Current and the thing put in practical use are EL elements which consist of an inorganic material which used the ZnS/Mn system for the luminous layer. However, since the driver voltage required for luminescence of this kind of inorganic EL element is as high as more than 100V, the drive approach becomes complicated and it has the trouble that a manufacturing cost is high. Moreover, since the effectiveness of blue luminescence is low, full-color-izing is difficult. On the other hand, since driver voltage required for luminescence can reduce sharply the thin film light emitting device using an organic material and it fully has the possibility of full-color-izing by application of various luminescent material, research is activating it in recent years.
[0003] In the laminating mold which consists of an electrode / hole injection layer / a luminous layer / an electrode especially to a luminescence agent tris (8-hydroxyquinoline) aluminum By using a 1 and 1'-bis(4-N and N-JITORI aminophenyl) cyclohexane for a hole-injection agent They are 1000 cd/m2 at the applied voltage not more than 10V. Since the report that the above brightness was obtained was made, the spur has been applied to development (Appl.Phys.Lett.51, 913, (1987)).
[0004]
[Problem(s) to be Solved by the Invention] Thus, although the thin film light emitting device using an organic material has suggested strongly a low-battery drive, the possibility of full-color-izing, etc., many technical problems which must be solved in respect of the engine performance are left behind. Especially the problem of property degradation accompanying the prolonged drive of about 10,000 hours is a technical problem which must be overcome. Moreover, since development of the luminescent material which enables luminescence of RGB three primary colors in full-color-izing, and the thickness of an organic layer are 1 micrometer or less, membrane formation nature is good, there is no electric defect of a pinhole etc., and there are development of an electron and the organic material excellent in the transport capacity of an electron hole, selection of the electrode material which is excellent in the impregnation nature of the charge to an organic layer, etc.
[0005] Development of an organic material still more possible [the viewpoint of mass-production nature to extensive manufacture] and cheap, amelioration of the component formation approach, etc. are important technical problems. Research is advanced focusing on the elucidation of a current degradation device, exfoliation of an up electrode and an organic film interface occurs with the moisture in atmospheric air from examination of the ambient atmosphere dependency at the time of a continuation drive, a degradation rate decreases by the guess of this causing degradation, and reduction of the current density at the time of a drive, and the knowledge of being connected to improvement in a life is being acquired.
[0006] This invention is made in view of an above-mentioned point, and that purpose is in offering the organic thin film light emitting device which is excellent in dependability by developing the component structure which it is hard to be influenced upwards of the moisture in atmospheric air, and can reduce current density.

[0007]
[Means for Solving the Problem] According to this invention, the above-mentioned purpose has an insulating transparence substrate, an electrode, and the combination of a charge impregnation layer / luminous layer. The laminating of said combination is carried out on an insulating transparence substrate through an electrode multistage, and while, as for an electrode, a positive electrode and a negative electrode are arranged by turns through combination, the same polar electrode is mutually connected electrically on an insulating transparence substrate. Said combination is attained by supposing that latter combination, on the whole, comes to cover the combination of the preceding paragraph on the occasion of the laminating.
[0008]
[Function] Since the laminating of the combination of a charge impregnation layer / luminous layer is carried out to multistage, the brightness of each stage can be made low, and it can integrate with the brightness of the combination of each stage, and the whole brightness can be raised. Therefore, the electrical potential difference impressed to the combination of each stage is made low, and it becomes possible to lower and drive the current density of each stage.
[0009] Moreover, since the combination of the preceding paragraph is covered with latter combination on the whole, out of atmospheric air, in the combination of the preceding paragraph, moisture does not diffuse it, but it can prevent component degradation by exfoliation of an electrode to it.
[0010]
[Example] Drawing 1 is the sectional view showing the organic thin film light emitting device concerning the example of this invention. Drawing 2 is the sectional view showing the organic thin film light emitting device concerning the example from which this invention differs. Drawing 3 is the sectional view showing the organic thin film light emitting device concerning the example from which this invention differs further.
[0011] Drawing 4 is the sectional view showing the organic thin film light emitting device concerning the example from which this invention differs further. 11, 21, 31, and 41 -- as for a negative electrode, and 33 and 39, for a hole injection layer, and 14, 16, 23, 27, 34, 38, 43, 48 and 50, an electronic injection layer, and 19, 29, 301 and 45 are [a luminous layer and 15 22, 28, 32, 42 and 49,300 / a positive electrode and 13 17, 24, 26, 35, 37 44, 47 and 51 / an insulating transparence substrate and 12 18, 25, 36, 46 and 52] DC power supplies.
 [0012] An insulating transparence substrate uses glass, resin, etc. which are the base material of a component. A transparent ingredient is used when becoming a luminescence side. A positive electrode consists of transparence electric conduction film, such as semipermeable membrane, such as gold and nickel, and an indium stannic-acid ghost (ITO), tin oxide (SnO2), and is formed by resistance heating vacuum evaporationo, electron beam evaporation, and the spatter. In order to give transparency, as for this positive electrode, it is desirable to make it the thickness of 100-3000A.
[0013] In the luminescence maximum field of light to which it was required in which to convey an electron hole efficiently and to pour it in, and it emitted light, the thing of a hole injection layer transparent as much as possible is desirable. as the membrane formation approach -- SUPINKO-TO, casting, and LB -- although there are law, resistance heating vacuum evaporationo, electron beam evaporation, etc., resistance heating vacuum evaporationo is common. Thickness is 100 thru/or 2000A and is 200 thru/or 800A suitably. As hole-injection matter, a hydrazone compound, a pyrazoline compound, a stilbene compound, an amine system compound, etc. are used. The typical hole-injection matter is shown below.
[0014]
[Formula 1]



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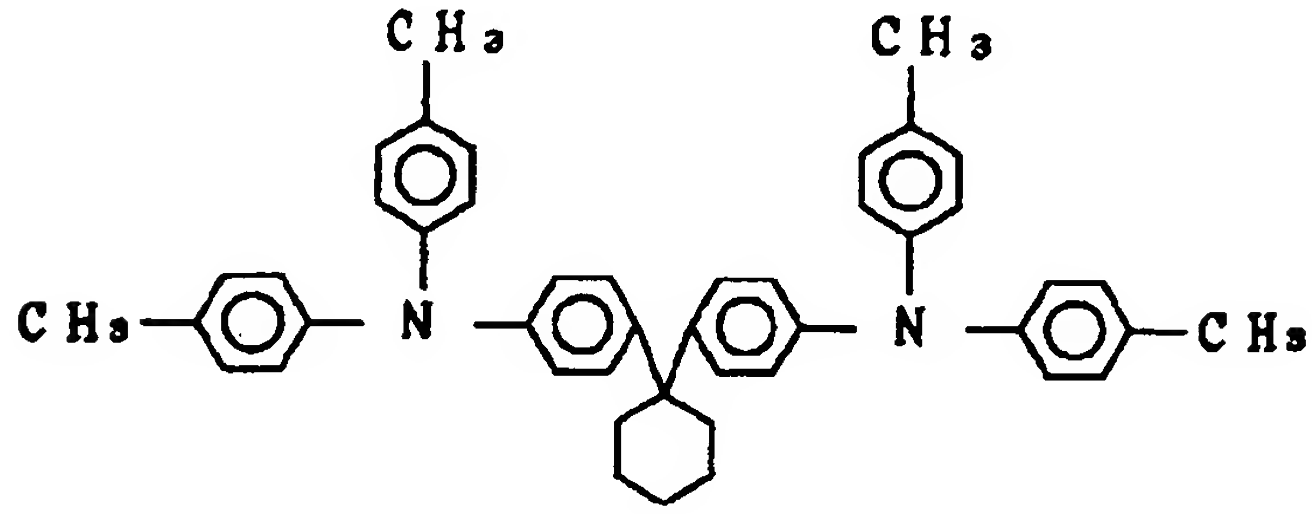

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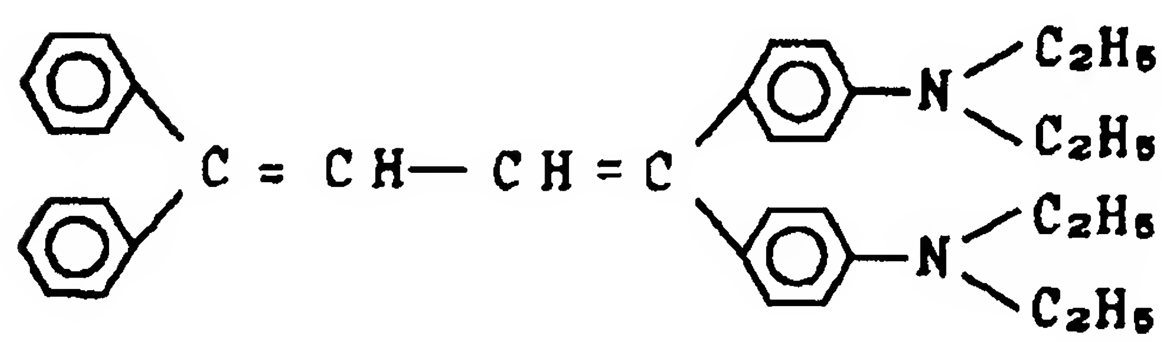

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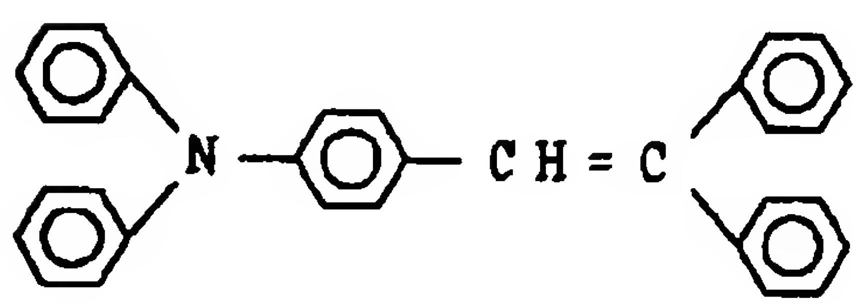

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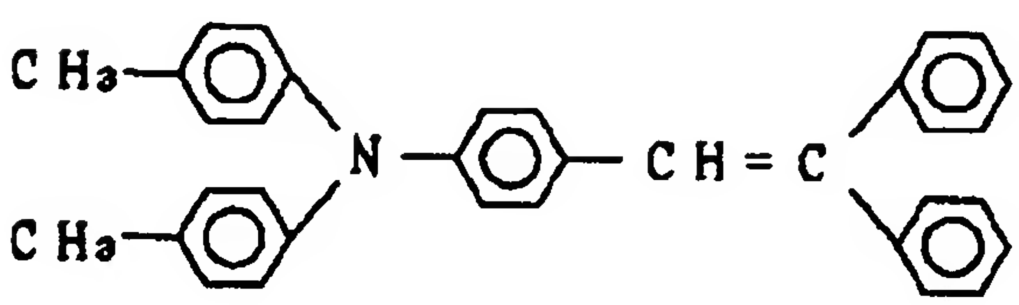

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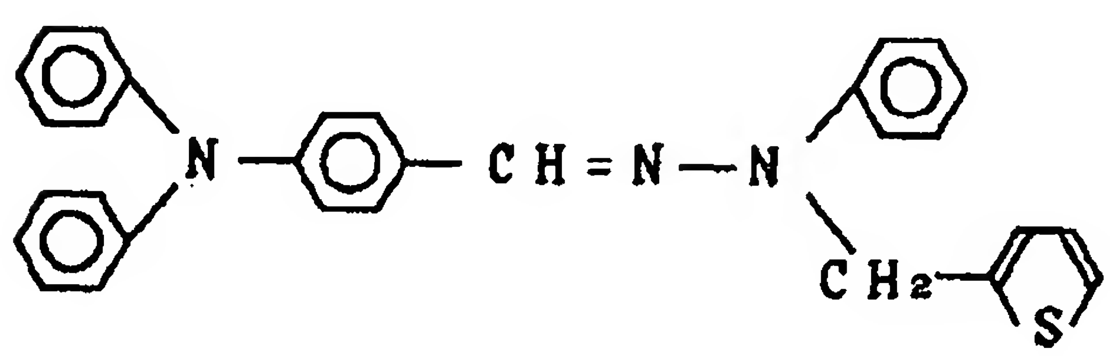

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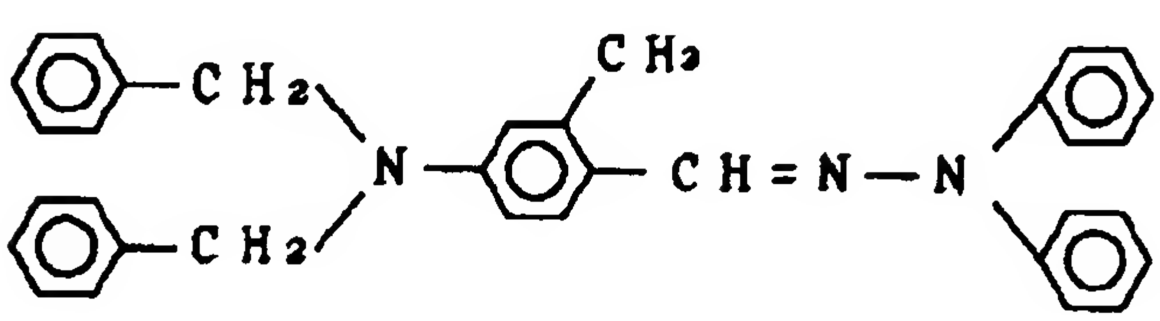

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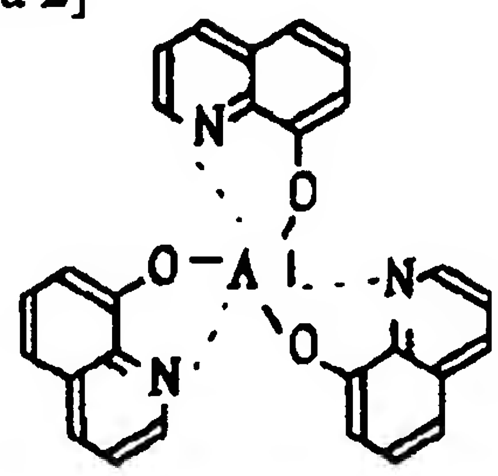
[0015] A luminous layer emits light efficiently by the recombination of the electron hole poured in from the hole injection layer or the positive electrode, and the electron poured in from the negative electrode or the electronic injection layer. the membrane formation approach -- SUPINKO-TO, casting, and LB -- although there are law, resistance heating vacuum evaporationo, electron beam evaporation, etc., resistance heating vacuum evaporationo is common. Although thickness is 100 thru/or 2000A, it is 200 thru/or 800A suitably. Typical photogene is shown below.
[0016]

[Formula 2]



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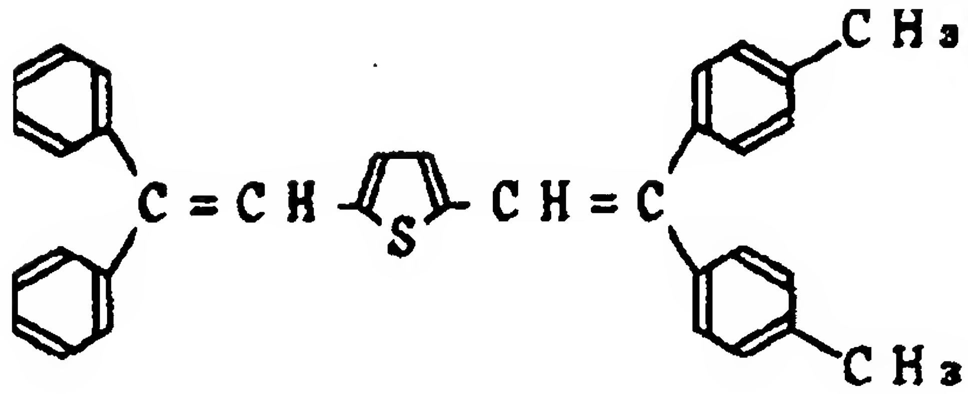

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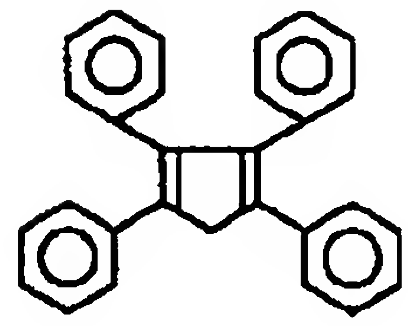

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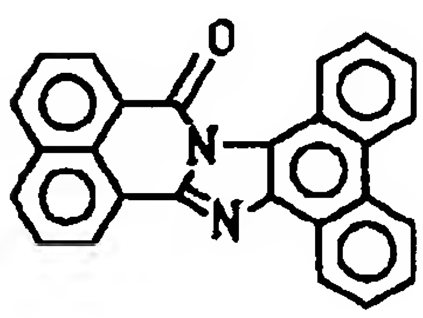

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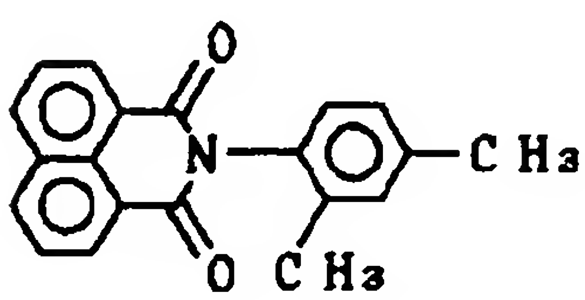

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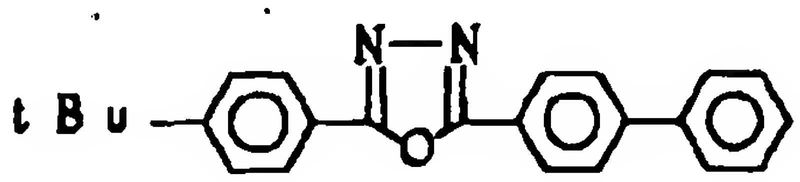
[0017] As for an electronic injection layer, it is desirable to pour an electron into a luminous layer efficiently. the membrane formation approach -- SUPINKO-TO, casting, and LB -- although there are law, resistance heating vacuum evaporationo, electron beam evaporation, etc., resistance heating vacuum evaporationo is common. Although thickness is 100 thru/or 2000A, it is 200 thru/or 800A suitably. An OKISA diazole derivative, a perylene derivative, etc. are used as electron injection matter. The typical electron injection matter is shown below.
[0018]
[Formula 3]



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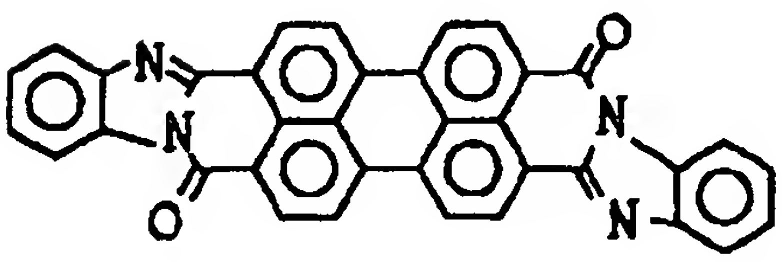

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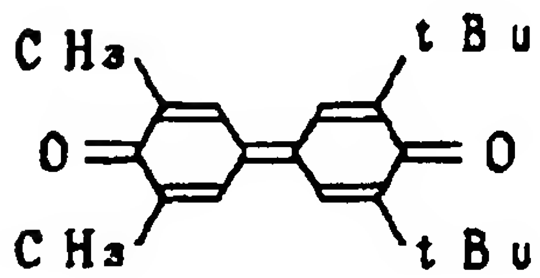


(7 - 3)

[0019] A negative electrode needs to inject an electron into an organic layer efficiently. As the membrane formation approach, resistance heating vacuum evaporationo, electron beam evaporation, and a spatter are used. The zinc oxide which added these alloys and a layered product, and aluminum, such as Mg, Ag, In, calcium, aluminum, etc. with a small work function, as a charge of negative-electrode material is used. As for the zinc oxide which added aluminum, it is desirable to consider as the aluminum addition 0.5 thru/or 3% of range by electron beam evaporation and the spatter, and to form membranes below 100 degrees C suitably the substrate temperature of 200 degrees C or less. Thickness is formed in 100 thru/or 2000A thickness. Semipermeable membrane, such as aluminum, is formed in 300 thru/or 800A thickness with resistance heating vacuum deposition.

Example 1 drawing 1 is the sectional view showing the organic thin film light emitting device concerning the example of this invention. The glass substrate 11 which formed the positive electrode 12 which is ITO of about 1000A of thickness was laid in resistance heating vacuum evaporationo equipment, and sequential membrane formation was carried out with the hole injection layer 13 and the luminous layer 14. Vacuum tub internal pressure was set to 8x10 to 4 Pa on the occasion of membrane formation. It formed in 500A thickness using the compound shown in said chemical formula (5-1) at a hole injection layer 13 by 2A/s in the boat temperature of 200 degrees C, and membrane formation rate. It heated at the boat temperature of about 200 degrees C using the compound continuously shown in said chemical formula (6-1) as a luminous layer 14, the membrane formation rate was carried out in about 2A/s, and it formed in 600A thickness.

[0020] Then, the substrate 11 was taken out from the vacuum tub, it laid in the sputtering system, the spatter of the mixed gas of Ar:O 2 = 1:1 was carried out with the sink by having used as the target the sample which carried aluminum wire on the zinc pellet, and the transparent negative electrode 15 which consists of an aluminum addition zinc oxide was formed in 1000A thickness. The visible-ray permeability of this aluminum addition zinc-oxide transparence negative electrode 15 is about 85%. Next, the sample was taken out from the sputtering system, and it laid in resistance heating vacuum evaporationo equipment again, and formed in the thickness of 500A in order of the luminous layer 16 and the hole injection layer 17 under the same conditions using the same ingredient as said luminous layer 14 and a hole injection layer 13. Finally Ag was formed in the thickness of 1000A as a positive electrode 18.

In the example of comparison 1 above-mentioned example, a luminous layer 16, a hole injection layer 17, and a positive electrode 18 were not formed, and also the organic thin film light emitting device was formed like the example 1.

[0021] When both example 1 and example 1 of a comparison impressed direct current voltage, uniform green (main wavelength: 550nm) luminescence was obtained. Brightness 100 cd/m2 The electrical potential difference which can be set, current density, luminous efficiency, and brightness half line are shown in Table 1.

[0022]

[Table 1]

	初期特性				輝度半減時間 (h)
	初期輝度 (cd/m²)	電　圧 (V)	電流密度 (mA/cm²)	発光効率 (lm/W)	
実施例1	100	10.7	2.8	0.52	880
比較例1	100	12.5	5.0	0.50	200

Since the two-step laminating of the combination which consists of a hole injection layer and a luminous layer in this example is carried out, the brightness which single combination pays can reduce the current density which is low, and ends, therefore single combination needs, and its life improves as the organic whole thin film light emitting device. Since the first step of combination is covered on the whole, invasion of the moisture to the first step of combination is prevented, and the dependability of combination [the second more step of] of an organic thin film light emitting device improves.
[0023] Moreover, since the electrical potential difference concerning a component is compared with the one-step component of the example of a comparison and it can decrease, the improvement in some [an EQC and] is found also in luminous efficiency.
Example 2 drawing 2 is the sectional view showing the organic thin film light emitting device concerning the example from which this invention differs. The transparent negative electrode 22 which consists of an aluminum addition zinc oxide was formed on the glass substrate 21 at the thickness of about 1000A of thickness. Next, sequential membrane formation of a luminous layer 23 and the hole injection layer 24 was carried out. The luminous layer 23 and the hole injection layer 24 were created on the same conditions as an example 1.
[0024] The positive electrode 25 was formed in 700A thickness using the same resistance heating vacuum evaporationo equipment using Au. The light transmittance of this positive electrode is about 70%. Sequential creation of a hole injection layer 26 and the luminous layer 27 was succeedingly carried out like the above. Finally, the alloy (Mg/Ag=10:1) of Mg and Ag was used and the negative electrode 28 was formed in 1000A thickness with resistance heating vacuum deposition.
In the example of comparison 2 above-mentioned example, a hole injection layer 26, a luminous layer 27, and a negative electrode 28 were not formed, and also the organic thin film light emitting device was formed like the example 2.
[0025] When both example 2 and example 2 of a comparison impressed direct current voltage, uniform green (main wavelength: 550nm) luminescence was obtained. Brightness 100 cd/m2 The electrical potential difference which can be set, current density, luminous efficiency, and brightness half line are shown in Table 2.
[0026]
[Table 2]

	初期特性				輝度半減時間 (h)
	初期輝度 (cd/m²)	電　圧 (V)	電流密度 (mA/cm²)	発光効率 (lm/W)	
実施例2	100	10.5	3.55	0.35	820
比較例2	100	13.6	6.3	0.36	193

Example 3 drawing 3 is the sectional view showing the organic thin film light emitting device concerning the example from which this invention differs further. The transparent negative electrode 32 which consists of an aluminum addition zinc oxide was formed on the glass substrate 31 at the thickness of about 1000A of thickness. Next, sequential membrane formation of an electronic injection layer 33, a luminous layer 34, and the hole injection layer 35 was carried out. The

electronic injection layer was heated at the boat temperature of about 300 degrees C using said chemical formula (7-2), and was formed in 400A thickness as 2A/s in membrane formation rate. The luminous layer 34 and the hole injection layer 35 were created on the same conditions as an example 1.

[0027] The positive electrode 36 was formed in 700A thickness using the same resistance heating vacuum evaporationo equipment using Au. The light transmittance of this positive electrode is about 70%. Sequential creation of a hole injection layer 37, a luminous layer 38, and the electronic injection layer 39 was succeedingly carried out like the above. Finally, the alloy (Mg/Ag=10:1) of Mg and Ag was used and the negative electrode 300 was formed in 1000A thickness with resistance heating vacuum deposition.

In the example of comparison 3 above-mentioned example 3, a hole injection layer 37, a luminous layer 38, and a negative electrode 300 were not formed, and also the organic thin film light emitting device was formed like the example 3.

[0028] When both example 3 and example 3 of a comparison impressed direct current voltage, uniform green (main wavelength: 550nm) luminescence was obtained. Brightness 100 cd/m2 The electrical potential difference which can be set, current density, luminous efficiency, and brightness half line are shown in Table 3.

[0029]

[Table 3]

	初期特性				輝度半減時間 (h)
	初期輝度 (cd/m²)	電　圧 (V)	電流密度 (mA/cm²)	発光効率 (lm/W)	
実施例3	100	12.3	3.40	0.38	850
比較例3	100	13.1	6.1	0.39	195

Example 4 drawing 4 is the sectional view showing the organic thin film light emitting device concerning the example from which this invention differs further. The transparent negative electrode 42 which consists of an aluminum addition zinc oxide was formed on the glass substrate 41 at the thickness of about 1000A of thickness. Next, sequential membrane formation of a luminous layer 43 and the hole injection layer 44 was carried out. The luminous layer 43 and the hole injection layer 44 were created on the same conditions as an example 1.

[0030] The positive electrode 46 was formed in 700A thickness using the same resistance heating vacuum evaporationo equipment using Au. The light transmittance of this positive electrode is about 70%. A hole injection layer 47, the luminous layer 48, the negative electrode 49, the luminous layer 50, and the hole injection layer 51 were succeedingly created like the above. The positive electrode 52 formed 1000A of Ag. As for this component, the 3-set laminating of the combination of a hole injection layer and a luminous layer is carried out.

It is the same as that of the example 2 of the example of comparison 4 aforementioned comparison.

[0031] When both example 4 and example 4 of a comparison impressed direct current voltage, uniform green (main wavelength: 550nm) luminescence was obtained. Brightness 100 cd/m2 The electrical potential difference which can be set, current density, luminous efficiency, and brightness half line are shown in Table 4.

[0032]

[Table 4]

	初期特性				輝度半減時間 (h)
	初期輝度 (cd/m²)	電　圧 (V)	電流密度 (mA/cm²)	発光効率 (lm/W)	
実施例4	100	9.3	2.4	0.47	1300
比較例4	100	12.5	5.0	0.50	200

[0033]
[Effect of the Invention] According to this invention, it has an insulating transparence substrate, an electrode, and the combination of a charge impregnation layer / luminous layer. The laminating of said combination is carried out on an insulating transparence substrate through an electrode multistage, and while, as for an electrode, a positive electrode and a negative electrode are arranged by turns through combination, the same polar electrode is mutually connected electrically on an insulating transparence substrate. Since latter combination, on the whole, comes to cover the combination of the preceding paragraph on the occasion of the laminating, said combination can make low the brightness of combination each stage of a charge impregnation layer / luminous layer, and can integrate with the brightness of the combination of each stage, and can raise the brightness of the whole component. Therefore, the organic thin film light emitting device which can make low the electrical potential difference impressed to the combination of each stage, can lower and drive the current density of each stage, and is excellent in dependability is obtained.
[0034] Moreover, since the combination which is in the preceding paragraph in the joint volume layer of an organic thin film light emitting device is covered with latter combination on the whole, the organic thin film light emitting device which moisture is not spread from the inside of atmospheric air, but can prevent component degradation by exfoliation of an electrode to the combination of the preceding paragraph, and is excellent in dependability is obtained.

[Translation done.]

TECHNICAL FIELD

[Industrial Application] This invention relates to the structure of an organic thin film light emitting device of starting the organic thin film light emitting device used as a source of luminescence of various displays, especially excelling in dependability.

[Translation done.]

* NOTICES *

PRIOR ART

[Description of the Prior Art] Development and utilization of various display devices are energetically advanced with rapid increase of the need of the flat display which replaces the conventional Braun tube. An electroluminescent element (it considers as an EL element below) is also based on such needs, and attention is attracted with the high resolution and the high visibility it is especially invisible on other displays as a spontaneous light emitting device of all solid-states. Current and the thing put in practical use are EL elements which consist of an inorganic material which used the ZnS/Mn system for the luminous layer. However, since the driver voltage required for luminescence of this kind of inorganic EL element is as high as more than 100V, the drive approach becomes complicated and it has the trouble that a manufacturing cost is high. Moreover, since the effectiveness of blue luminescence is low, full-color-izing is difficult. On the other hand, since driver voltage required for luminescence can reduce sharply the thin film light emitting device using an organic material and it fully has the possibility of full-color-izing by application of various luminescent material, research is activating it in recent years.
[0003] In the laminating mold which consists of an electrode / hole injection layer / a luminous layer / an electrode especially to a luminescence agent tris (8-hydroxyquinoline) aluminum By using a 1 and 1'-bis(4-N and N-JITORI aminophenyl) cyclohexane for a hole-injection agent They are 1000 cd/m2 at the applied voltage not more than 10V. Since the report that the above brightness was obtained was made, the spur has been applied to development (Appl.Phys.Lett.51, 913, (1987)).

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] According to this invention, it has an insulating transparence substrate, an electrode, and the combination of a charge impregnation layer / luminous layer. The laminating of said combination is carried out on an insulating transparence substrate through an electrode multistage, and while, as for an electrode, a positive electrode and a negative electrode are arranged by turns through combination, the same polar electrode is mutually connected electrically on an insulating transparence substrate. Since latter combination, on the whole, comes to cover the combination of the preceding paragraph on the occasion of the laminating, said combination can make low the brightness of combination each stage of a charge impregnation layer / luminous layer, and can integrate with the brightness of the combination of each stage, and can raise the brightness of the whole component. Therefore, the organic thin film light emitting device which can make low the electrical potential difference impressed to the combination of each stage, can lower and drive the current density of each stage, and is excellent in dependability is obtained.
[0034] Moreover, since the combination which is in the preceding paragraph in the joint volume layer of an organic thin film light emitting device is covered with latter combination on the whole, the organic thin film light emitting device which moisture is not spread from the inside of atmospheric air, but can prevent component degradation by exfoliation of an electrode to the combination of the preceding paragraph, and is excellent in dependability is obtained.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Thus, although the thin film light emitting device using an organic material has suggested strongly a low-battery drive, the possibility of full-color-izing, etc., many technical problems which must be solved in respect of the engine performance are left behind. Especially the problem of property degradation accompanying the prolonged drive of about 10,000 hours is a technical problem which must be overcome. Moreover, since development of the luminescent material which enables luminescence of RGB three primary colors in full-color-izing, and the thickness of an organic layer are 1 micrometer or less, membrane formation nature is good, there is no electric defect of a pinhole etc., and there are development of an electron and the organic material excellent in the transport capacity of an electron hole, selection of the electrode material which is excellent in the impregnation nature of the charge to an organic layer, etc.
[0005] Development of an organic material still more possible [the viewpoint of mass-production nature to extensive manufacture] and cheap, amelioration of the component formation approach, etc. are important technical problems. Research is advanced focusing on the elucidation of a current degradation device, exfoliation of an up electrode and an organic film interface occurs with the moisture in atmospheric air from examination of the ambient atmosphere dependency at the time of a continuation drive, a degradation rate decreases by the guess of this causing degradation, and reduction of the current density at the time of a drive, and the knowledge of being connected to improvement in a life is being acquired.
[0006] This invention is made in view of an above-mentioned point, and that purpose is in offering the organic thin film light emitting device which is excellent in dependability by developing the component structure which it is hard to be influenced upwards of the moisture in atmospheric air, and can reduce current density.

[Translation done.]

[Translation done.]

JAPANESE [JP,06-176870,A]

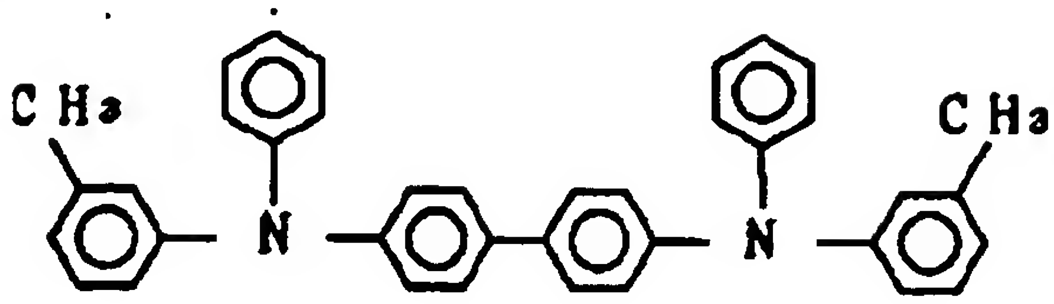
CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS OPERATION EXAMPLE DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

* NOTICES *

EXAMPLE

[Example] Drawing 1 is the sectional view showing the organic thin film light emitting device concerning the example of this invention. Drawing 2 is the sectional view showing the organic thin film light emitting device concerning the example from which this invention differs. Drawing 3 is the sectional view showing the organic thin film light emitting device concerning the example from which this invention differs further.
[0011] Drawing 4 is the sectional view showing the organic thin film light emitting device concerning the example from which this invention differs further. 11, 21, 31, and 41 -- as for a negative electrode, and 33 and 39, for a hole injection layer, and 14, 16, 23, 27, 34, 38, 43, 48 and 50, an electronic injection layer, and 19, 29, 301 and 45 are [a luminous layer and 15 22, 28, 32, 42 and 49,300 / a positive electrode and 13 17, 24, 26, 35, 37 44, 47 and 51 / an insulating transparence substrate and 12 18, 25, 36, 46 and 52] DC power supplies.
[0012] An insulating transparence substrate uses glass, resin, etc. which are the base material of a component. A transparent ingredient is used when becoming a luminescence side. A positive electrode consists of transparence electric conduction film, such as semipermeable membrane, such as gold and nickel, and an indium stannic-acid ghost (ITO), tin oxide (SnO_2), and is formed by resistance heating vacuum evaporationo, electron beam evaporation, and the spatter. In order to give transparency, as for this positive electrode, it is desirable to make it the thickness of 100-3000A.
[0013] In the luminescence maximum field of light to which it was required in which to convey an electron hole efficiently and to pour it in, and it emitted light, the thing of a hole injection layer transparent as much as possible is desirable. as the membrane formation approach -- SUPINKO-TO, casting, and LB -- although there are law, resistance heating vacuum evaporationo, electron beam evaporation, etc., resistance heating vacuum evaporationo is common. Thickness is 100 thru/or 2000A and is 200 thru/or 800A suitably. As hole-injection matter, a hydrazone compound, a pyrazoline compound, a stilbene compound, an amine system compound, etc. are used. The typical hole-injection matter is shown below.
[0014]
[Formula 1]



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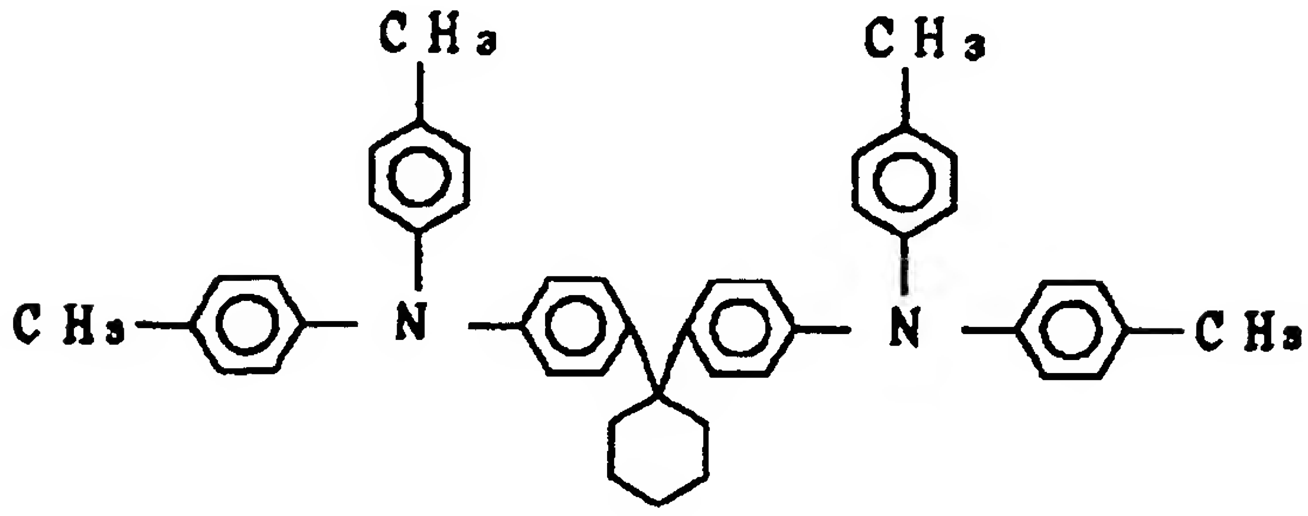

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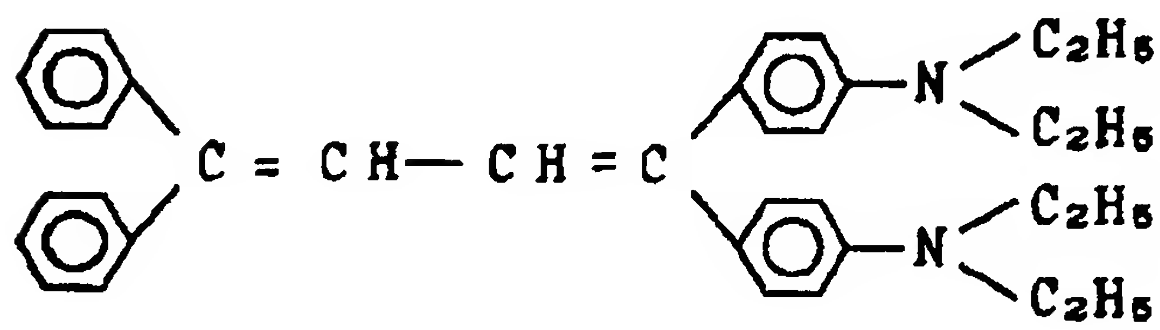

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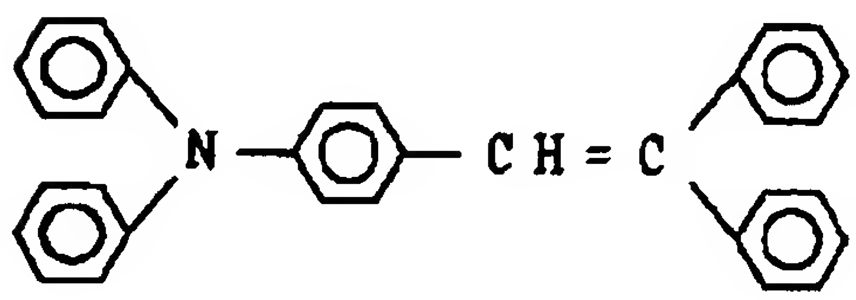

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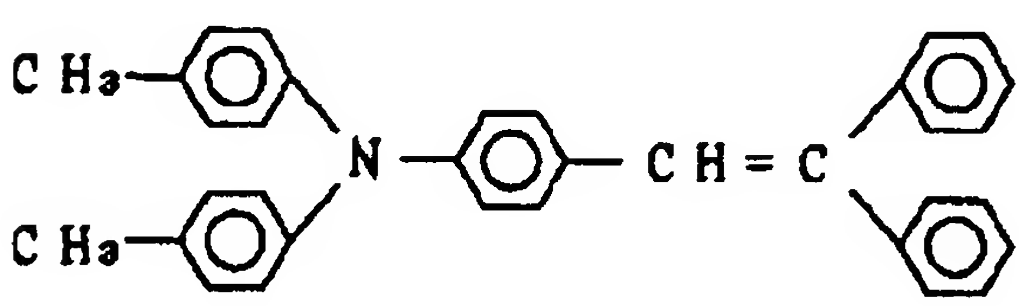

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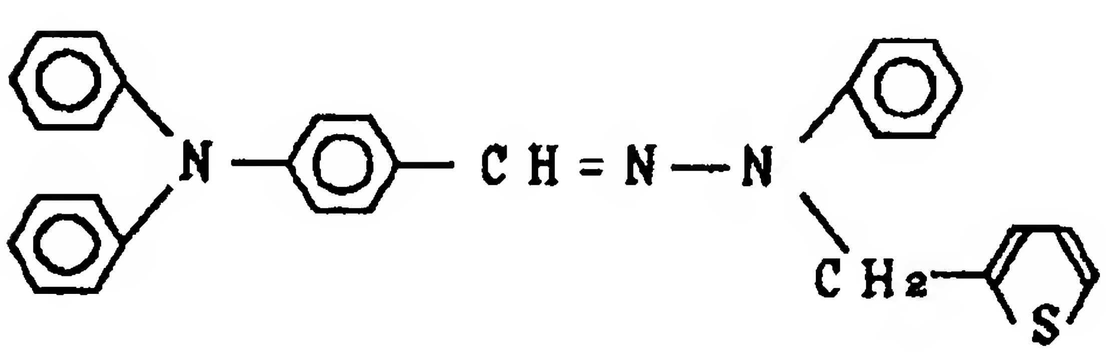

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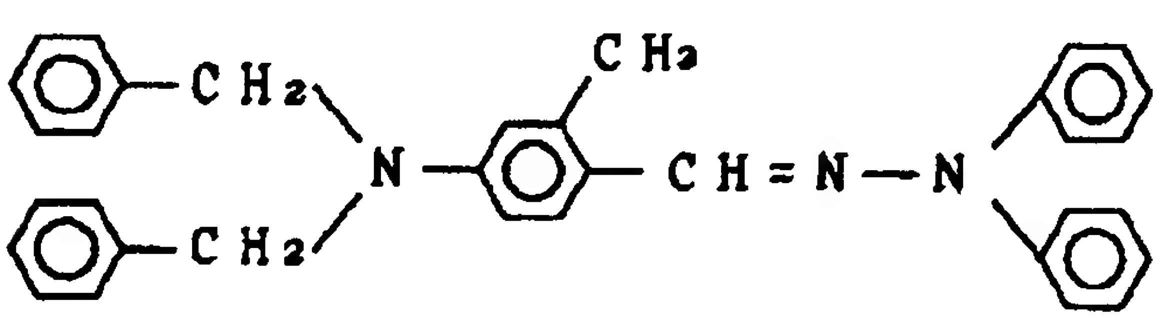
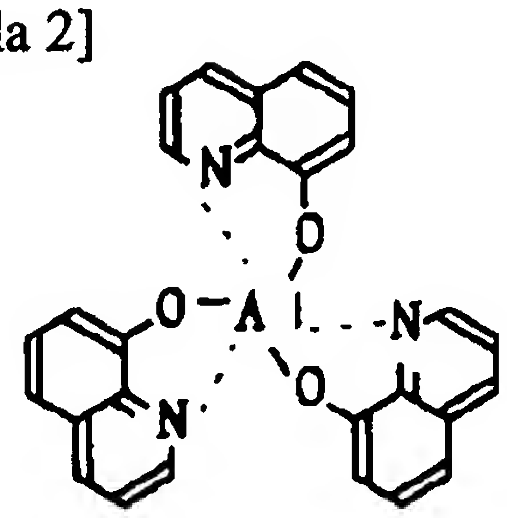


(5 - 7)

[0015] A luminous layer emits light efficiently by the recombination of the electron hole poured in from the hole injection layer or the positive electrode, and the electron poured in from the negative electrode or the electronic injection layer. the membrane formation approach -- SUPINKO-TO, casting, and LB -- although there are law, resistance heating vacuum evaporationo, electron beam evaporation, etc., resistance heating vacuum evaporationo is common. Although thickness is 100 thru/or 2000A, it is 200 thru/or 800A suitably. Typical photogene is shown below.
[0016]

[Formula 2]



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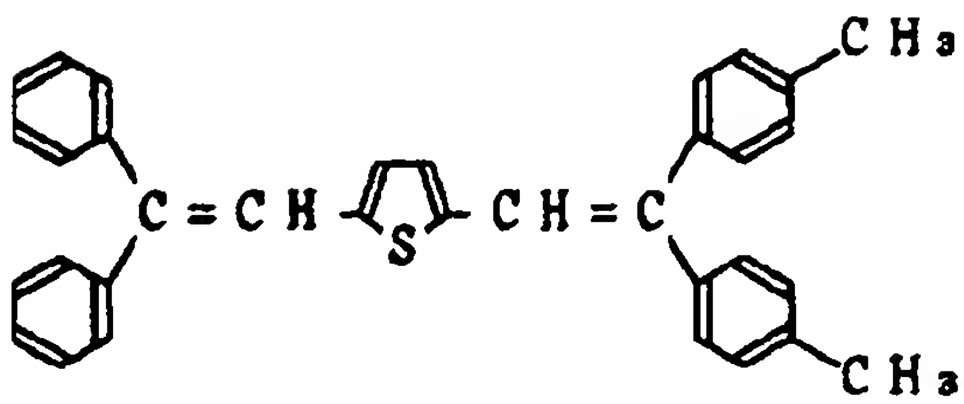

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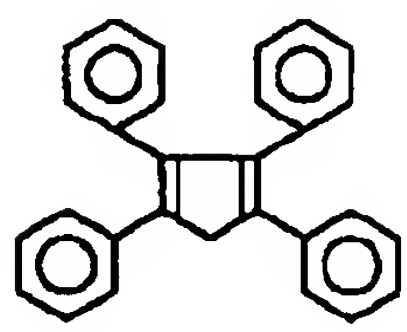

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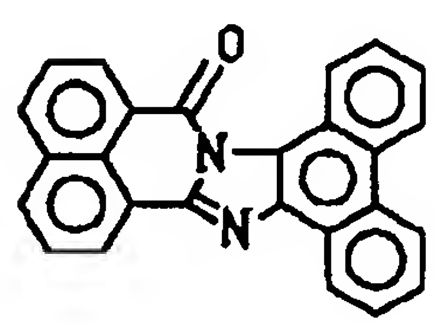

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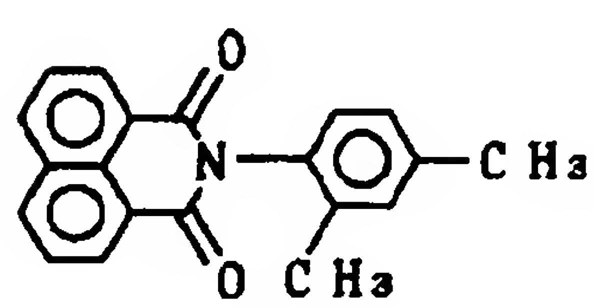
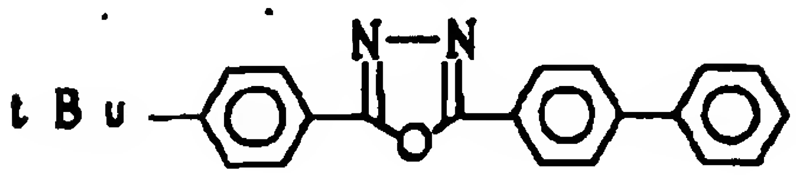


(6 - 5)

[0017] As for an electronic injection layer, it is desirable to pour an electron into a luminous layer efficiently. the membrane formation approach -- SUPINKO-TO, casting, and LB -- although there are law, resistance heating vacuum evaporationo, electron beam evaporation, etc., resistance heating vacuum evaporationo is common. Although thickness is 100 thru/or 2000A, it is 200 thru/or 800A suitably. An OKISA diazole derivative, a perylene derivative, etc. are used as electron injection matter. The typical electron injection matter is shown below.

[0018]

[Formula 3]



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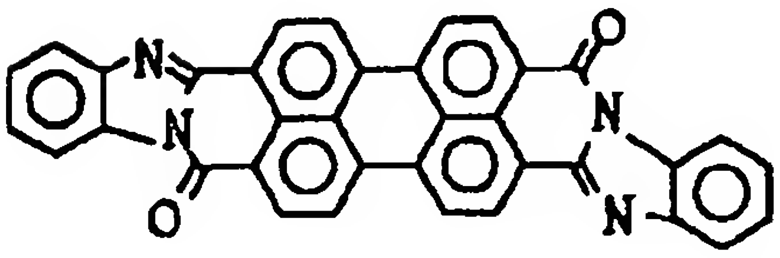

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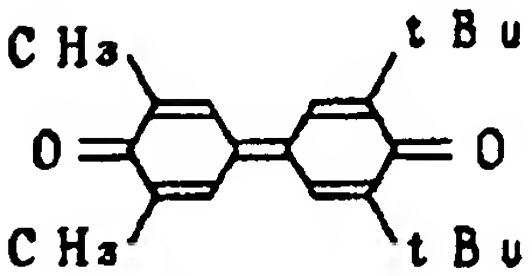

(7 - 3)

[0019] A negative electrode needs to inject an electron into an organic layer efficiently. As the membrane formation approach, resistance heating vacuum evaporationo, electron beam evaporation, and a spatter are used. The zinc oxide which added these alloys and a layered product, and aluminum, such as Mg, Ag, In, calcium, aluminum, etc. with a small work function, as a charge of negative-electrode material is used. As for the zinc oxide which added aluminum, it is desirable to consider as the aluminum addition 0.5 thru/or 3% of range by electron beam evaporation and the spatter, and to form membranes below 100 degrees C suitably the substrate temperature of 200 degrees C or less. Thickness is formed in 100 thru/or 2000A thickness. Semipermeable membrane, such as aluminum, is formed in 300 thru/or 800A thickness with resistance heating vacuum deposition.

Example 1 drawing 1 is the sectional view showing the organic thin film light emitting device concerning the example of this invention. The glass substrate 11 which formed the positive electrode 12 which is ITO of about 1000A of thickness was laid in resistance heating vacuum evaporationo equipment, and sequential membrane formation was carried out with the hole injection layer 13 and the luminous layer 14. Vacuum tub internal pressure was set to 8x10 to 4 Pa on the occasion of membrane formation. It formed in 500A thickness using the compound shown in said chemical formula (5-1) at a hole injection layer 13 by 2A/s in the boat temperature of 200 degrees C, and membrane formation rate. It heated at the boat temperature of about 200 degrees C using the compound continuously shown in said chemical formula (6-1) as a luminous layer 14, the membrane formation rate was carried out in about 2A/s, and it formed in 600A thickness.

[0020] Then, the substrate 11 was taken out from the vacuum tub, it laid in the sputtering system, the spatter of the mixed gas of Ar:O 2 = 1:1 was carried out with the sink by having used as the target the sample which carried aluminum wire on the zinc pellet, and the transparent negative electrode 15 which consists of an aluminum addition zinc oxide was formed in 1000A thickness. The visible-ray permeability of this aluminum addition zinc-oxide transparence negative electrode 15 is about 85%. Next, the sample was taken out from the sputtering system, and it laid in resistance heating vacuum evaporationo equipment again, and formed in the thickness of 500A in order of the luminous layer 16 and the hole injection layer 17 under the same conditions using the same ingredient as said luminous layer 14 and a hole injection layer 13. Finally Ag was formed in the thickness of 1000A as a positive electrode 18.

In the example of comparison 1 above-mentioned example, a luminous layer 16, a hole injection layer 17, and a positive electrode 18 were not formed, and also the organic thin film light emitting device was formed like the example 1.

[0021] When both example 1 and example 1 of a comparison impressed direct current voltage, uniform green (main wavelength: 550nm) luminescence was obtained. Brightness 100 cd/m2 The electrical potential difference which can be set, current density, luminous efficiency, and brightness half line are shown in Table 1.

[0022]

[Table 1]

	初期特性				輝度半減時間 (h)
	初期輝度 (cd/m²)	電　圧 (V)	電流密度 (mA/cm²)	発光効率 (lm/W)	
実施例1	100	10.7	2.8	0.52	880
比較例1	100	12.5	5.0	0.50	200

Since the two-step laminating of the combination which consists of a hole injection layer and a luminous layer in this example is carried out, the brightness which single combination pays can reduce the current density which is low, and ends, therefore single combination needs, and its life improves as the organic whole thin film light emitting device. Since the first step of combination is covered on the whole, invasion of the moisture to the first step of combination is prevented, and the dependability of combination [the second more step of] of an organic thin film light emitting device improves.
[0023] Moreover, since the electrical potential difference concerning a component is compared with the one-step component of the example of a comparison and it can decrease, the improvement in some [an EQC and] is found also in luminous efficiency.
Example 2 drawing 2 is the sectional view showing the organic thin film light emitting device concerning the example from which this invention differs. The transparent negative electrode 22 which consists of an aluminum addition zinc oxide was formed on the glass substrate 21 at the thickness of about 1000A of thickness. Next, sequential membrane formation of a luminous layer 23 and the hole injection layer 24 was carried out. The luminous layer 23 and the hole injection layer 24 were created on the same conditions as an example 1.
[0024] The positive electrode 25 was formed in 700A thickness using the same resistance heating vacuum evaporationo equipment using Au. The light transmittance of this positive electrode is about 70%. Sequential creation of a hole injection layer 26 and the luminous layer 27 was succeedingly carried out like the above. Finally, the alloy (Mg/Ag=10:1) of Mg and Ag was used and the negative electrode 28 was formed in 1000A thickness with resistance heating vacuum deposition.
In the example of comparison 2 above-mentioned example, a hole injection layer 26, a luminous layer 27, and a negative electrode 28 were not formed, and also the organic thin film light emitting device was formed like the example 2.
[0025] When both example 2 and example 2 of a comparison impressed direct current voltage, uniform green (main wavelength: 550nm) luminescence was obtained. Brightness 100 cd/m2 The electrical potential difference which can be set, current density, luminous efficiency, and brightness half line are shown in Table 2.
[0026]
[Table 2]

	初期特性				輝度半減時間 (h)
	初期輝度 (cd/m²)	電　圧 (V)	電流密度 (mA/cm²)	発光効率 (lm/W)	
実施例2	100	10.5	3.55	0.35	820
比較例2	100	13.6	6.3	0.36	193

Example 3 drawing 3 is the sectional view showing the organic thin film light emitting device concerning the example from which this invention differs further. The transparent negative electrode 32 which consists of an aluminum addition zinc oxide was formed on the glass substrate 31 at the thickness of about 1000A of thickness. Next, sequential membrane formation of an electronic injection layer 33, a luminous layer 34, and the hole injection layer 35 was carried out. The

electronic injection layer was heated at the boat temperature of about 300 degrees C using said chemical formula (7-2), and was formed in 400A thickness as 2A/s in membrane formation rate. The luminous layer 34 and the hole injection layer 35 were created on the same conditions as an example 1.
[0027] The positive electrode 36 was formed in 700A thickness using the same resistance heating vacuum evaporationo equipment using Au. The light transmittance of this positive electrode is about 70%. Sequential creation of a hole injection layer 37, a luminous layer 38, and the electronic injection layer 39 was succeedingly carried out like the above. Finally, the alloy (Mg/Ag=10:1) of Mg and Ag was used and the negative electrode 300 was formed in 1000A thickness with resistance heating vacuum deposition.
In the example of comparison 3 above-mentioned example 3, a hole injection layer 37, a luminous layer 38, and a negative electrode 300 were not formed, and also the organic thin film light emitting device was formed like the example 3.
[0028] When both example 3 and example 3 of a comparison impressed direct current voltage, uniform green (main wavelength: 550nm) luminescence was obtained. Brightness 100 cd/m2 The electrical potential difference which can be set, current density, luminous efficiency, and brightness half line are shown in Table 3.
[0029]
[Table 3]

	初期特性				輝度半減時間 (h)
	初期輝度 (cd/m²)	電 圧 (V)	電流密度 (mA/cm²)	発光効率 (lm/W)	
実施例3	100	12.3	3.40	0.38	850
比較例3	100	13.1	6.1	0.39	195

Example 4 drawing 4 is the sectional view showing the organic thin film light emitting device concerning the example from which this invention differs further. The transparent negative electrode 42 which consists of an aluminum addition zinc oxide was formed on the glass substrate 41 at the thickness of about 1000A of thickness. Next, sequential membrane formation of a luminous layer 43 and the hole injection layer 44 was carried out. The luminous layer 43 and the hole injection layer 44 were created on the same conditions as an example 1.
[0030] The positive electrode 46 was formed in 700A thickness using the same resistance heating vacuum evaporationo equipment using Au. The light transmittance of this positive electrode is about 70%. A hole injection layer 47, the luminous layer 48, the negative electrode 49, the luminous layer 50, and the hole injection layer 51 were succeedingly created like the above. The positive electrode 52 formed 1000A of Ag. As for this component, the 3-set laminating of the combination of a hole injection layer and a luminous layer is carried out.
It is the same as that of the example 2 of the example of comparison 4 aforementioned comparison.
[0031] When both example 4 and example 4 of a comparison impressed direct current voltage, uniform green (main wavelength: 550nm) luminescence was obtained. Brightness 100 cd/m2 The electrical potential difference which can be set, current density, luminous efficiency, and brightness half line are shown in Table 4.
[0032]
[Table 4]

	初期特性				輝度半減時間 (h)
	初期輝度 (cd/m²)	電　圧 (V)	電流密度 (mA/cm²)	発光効率 (lm/W)	
実施例4	１００	9.3	2.4	0.47	１３００
比較例4	１００	12.5	5.0	0.50	２００

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The sectional view showing the organic thin film light emitting device concerning the example of this invention
[Drawing 2] The sectional view showing the organic thin film light emitting device concerning the example from which this invention differs
[Drawing 3] The sectional view showing the organic thin film light emitting device concerning the example from which this invention differs further
[Drawing 4] The sectional view showing the organic thin film light emitting device concerning the example from which this invention differs further
[Description of Notations]
11, 21, 31, 41 Insulating transparence substrate
12, 18, 25, 36, 46, 52 Positive electrode
13, 17, 24, 26, 35, 37, 44, 47, 51 Hole injection layer
14, 16, 23, 27, 34, 38, 43, 48, 50 Luminous layer
15, 22, 28, 32, 42, 49,300 Negative electrode
33 39 Electronic injection layer
19, 29, 301, 45 DC power supply

[Translation done.]

JAPANESE [JP,06-176870,A]

[Translation done.]

CLAIMS

[Claim(s)]
[Claim 1] It has an insulating transparence substrate, an electrode, and the combination of a charge impregnation layer / luminous layer. The laminating of said combination is carried out on an insulating transparence substrate through an electrode multistage, and while, as for an electrode, a positive electrode and a negative electrode are arranged by turns through combination, the same polar electrode is mutually connected electrically on an insulating transparence substrate. Said combination is an organic thin film light emitting device characterized by on the whole latter combination coming to cover the combination of the preceding paragraph on the occasion of the laminating.
[Claim 2] It is the organic thin film light emitting device characterized by the combination of a charge impregnation layer / luminous layer being a hole injection layer and a luminous layer in an organic thin film light emitting device according to claim 1.
[Claim 3] It is the organic thin film light emitting device characterized by being the luminous layer by which the combination of a charge impregnation layer / luminous layer was inserted into a hole injection layer, an electronic injection layer, and front 2 persons in the organic thin film light emitting device according to claim 1.
[Claim 4] It is the organic thin film light emitting device characterized by each luminous layer consisting of the same photogene in an organic thin film light emitting device according to claim 1.
[Claim 5] It is the organic thin film light emitting device characterized by each charge impregnation layer consisting of the same charge impregnation matter in an organic thin film light emitting device according to claim 1.

[Translation done.]